

Ergonomics in Dentistry - To Stay Fit and Healthy

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Abstract

Musculoskeletal disorders (MSD's) have become increasingly common worldwide during the past decades. Work-related MSDs are of serious concern to many organizations, including industry, insurance and healthcare. MSD's including pain, weakness, parasthesia are reported to be associated with a wide range of occupation. A well-adapted design of the workplace is a basic requirement for maintaining musculoskeletal health that will in turn enhance work efficiency. Ergonomics in an applied science concerned with designing products and procedures for maximum

efficiency and safety. It is a scientific discipline that studies workers and their relationship to their occupational environment. The aim of present review of literature is to identify potential risk of MSDs in dental office amongst all concerned personnel and discuss various preventive methods and remedies for problems arising due to poor ergonomics.

Keywords: Ergonomics, Musculoskeletal disorders, MSD, Dentistry

Introduction

Musculoskeletal disorders (MSDs) are among the most common causes of long-term disability. Due to spiraling

incidences of MSDs over a period of time and their subsequent impact on industrial profits and quality of individual lives, the MSDs have received considerable attention since 1990s from ergonomists, researchers, and other healthcare professionals.

The nature of the dental profession and the postures assumed by the dental surgeons during their professional work has a huge impact on the dental surgeon's body and carries with it a high risk of musculoskeletal disorders (MSDs). To perform efficiently and effectively, they shall always like to attain a position that allows them to achieve optimum access, visibility, comfort, and control at all times. Good ergonomic design of the workplace is a basic requirement for facilitating the balanced musculoskeletal health that will enable longer, healthier career, enhance productivity, and minimize MSDs among dental surgeons.²

Recently, "Ergonomics" has become a popular term. The term has been used with most professions but increasingly in the dental profession. In Greek, "Ergo," means work and, "Nomos," means natural laws or systems. Ergonomics is a way to work smarter-not harder- by designing tools, equipment, work areas and tasks to fit the individual worker. It leads to improved productivity, reduced injuries, and greater worker satisfaction.³

Proper ergonomic design is necessary to prevent repetitive strain injuries, which can develop over time and lead to long-term disability. Ergonomics is concerned with the efficiency of persons in their working environment. It takes account of the worker's capabilities and limitations to ensure that task, equipment's, information, and the environment suit each worker.⁴

Hence the aim of present review of literature is to identify potential risk of MSDs in dental office amongst all concerned personnel and discuss various preventive methods and remedies for problems arising due to poor ergonomics.

Musculoskeletal disorders in Dentistry

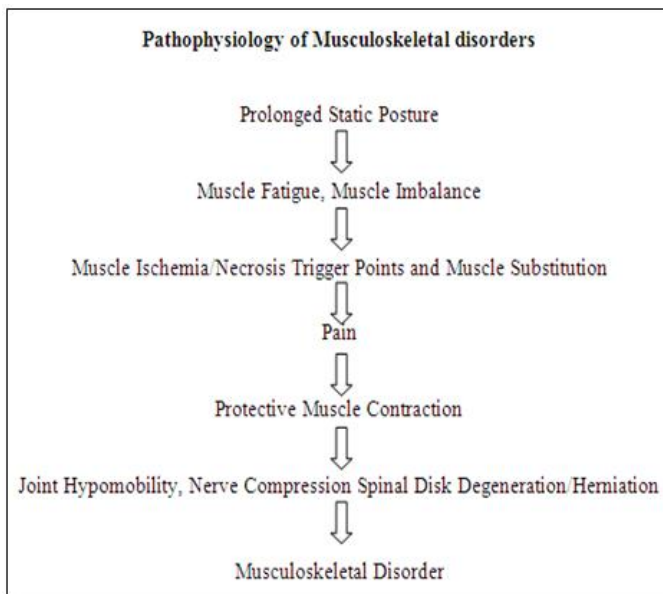
Musculoskeletal disorders are a wide range of inflammatory and degenerative disorders of muscles, tendons, and nerves. These disorders can result in pain and functional impairment affecting the neck, upper back, lower back, shoulders, elbows, wrists, and hands.⁵ Examples are carpal tunnel syndrome, tendonitis, thoracic outlet syndrome, and tension neck syndrome. Epidemiologic literature has grouped these disorders as clinically well-defined (such as tendonitis and carpal tunnel syndrome), less clinically well-defined (such as tension neck syndrome) and nonspecific (such as repetitive strain injury, cumulative trauma disorder, and overuse syndrome).⁶

Dentists apply accurate motor skills with concentrated hand-eye coordination to perform dental procedures in a dynamic setting. Dental practitioners often choose uncomfortable and asymmetric positions while balancing the head forward and rotated to the side with the arms held out from the body. These positions, if held for prolonged period time, might overstress muscles and joints, particularly those of the neck, shoulder, and back, leading to musculoskeletal symptoms.⁷

Frequent movements
Weak and Inappropriate postures
Standing or sitting in one posture for long periods
Poor positional muscle strength and Poor flexibility
Stress

Infrequent break times
Improper design of dental chair and magnification tools
Inappropriate work habits
Genetics
Poor nutrition
Environmental factors and Medical conditions
Improper lighting and vibration

Fig 1:



Various Musculoskeletal Disorders⁹

- Nerve Entrapment Disorders: Carpal tunnel syndrome, Ulnar neuropathy.
- Occupational Disorders of the Neck and Brachial Plexus: Tension neck syndrome, Cervical spondylosis, Cervical disc disease, Brachial plexus compression
- Shoulder disorders: Trapezius myalgia, Rotator Cuff Tendonitis, Rotator cuff tears, and Adhesive capsulitis
- Tendonitis of the Elbow, Forearm and Wrist: de Quervain's disease, Tendonitis, Tenosynovitis, Epicondylitis
- Hand-Arm Vibration Syndrome: Raynaud's disease
- Low Back Disorders: Chronic low back pain

Ergonomics

Ergonomics is an applied science concerned with designing products and procedures for maximum efficiency and safety.¹⁰ Ergonomics, as a discipline, has its formal beginnings immediately after the Second World War. During this time, the focus of concern expanded to include worker safety, as well as productivity. The studies of efficiency carried out by psychologists on Pilots, Radar, and Sonar operators in Great Britain during the war and immediately after it, showed the importance of designing technologies that should adapt sizably, statically, and dynamically to the human body and that should stimulate the physical and mental status of the human beings.¹

When applied to dentistry, ergonomics seeks to reduce cognitive and physical stress, prevent occupational diseases related to the practice of dentistry, and improve productivity, with better quality and greater comfort for both the professional and the patient.¹¹ According to American Dental Association's Ergonomics for Dental Students (2011)¹², Ergonomics, therefore, is an applied science concerned with designing products and procedures for maximum efficiency and safety. Ergonomics modifies tools and tasks to meet the needs of people, rather than forcing people to accommodate the task or tool.

Ergonomic Strategies in Dentistry

Musculoskeletal problems can be managed or alleviated effectively using a multifaceted approach that includes:

Postural Awareness

A good posture provides the dentist more working energy, lower stress level, increased comfort, lack of pain and muscular tension, and a lower risk for therapeutic errors.¹³ The balanced or neutral posture is the reference point for the proper working posture and encouraged to

be kept within the limits imposed by the practice conditions, throughout all stages of the clinical acts. This is a seated posture, which is natural, unforced, stress free, and symmetrical that takes into account the loco motor system of the human body.¹⁴ Maintain the low back curve:¹⁵ Maintaining the low back curve when sitting can reduce or prevent low back pain. The following practices can help maintain the low back curve:

- Tilt the seat angle slightly forward five to 15 degrees to increase the low back curve.
- Sit close to the patient and position knees under the patient's chair if possible. This can be facilitated by tilting the seat and using patient chairs that have thin upper backs and headrests.
- Consider using a saddle-style operator stool that promotes the natural low back curve by increasing the hip angle to approximately 130 degrees.
- Adjust the chair so your hips are slightly higher than your knees and distribute your weight evenly by placing your feet firmly on the floor.
- Use the lumbar support of the chair as much as possible by adjusting the lumbar support forward to contact your back.
- Stabilize the low back curve by contracting the transverse abdominal muscles.
- Pivot forward from your hips, not your waist.

Patient Positioning

Supine positioning of the patient in the chair is usually the most effective way to help to maintain neutral posture. The chair should be raised so the operator's thighs can freely turn beneath the patient's chair. Clearance around the patient's head should at least allow unimpeded operator access from the 7 to 12:30 o'clock position, for right-handed operators.

For most intraoral access sites, the maxillary plane should be extended 7° beyond the vertical. For treating the maxillary second and third molars, the maxillary plane should be 25° beyond the vertical. For the mandibular anterior teeth, bring the patients chin down so the maxillary plane is 8° ahead of the vertical.¹⁶⁻¹⁸

Four Handed Dentistry

Four handed dentistry has been described as a practice in which the dentist and assistant work as a team to perform some operations planned with an intention to benefit the patient. It involves the use of a trained chair side assistant to work constantly with the dentist in performing the technical procedure during the course of any dental procedure in the dental setup. Proper utilization of an extra pair of hands of the dental auxiliary in a four-handed dentistry setup is generally regarded as an ideal method of delivering dental services. To practice true four-handed dentistry, the following criteria must be met:¹⁹

- All equipment must be ergonomically designed
- The operating team and patient must be seated comfortably in ergonomically designed equipment
- Preset trays should be utilized
- The dentist should assign all legally delegable duties to qualified auxiliaries based on the state's guidelines
- The patient's treatment plan should be planned in advance in a logical sequence.

Hand Instruments

No industry standard for an 'ergonomic' instrument currently exists. A round handle, as opposed to a hexagonal handle, with hard edges will reduce muscular stress and digital nerve compression. However, a smooth, round-handled instrument requires more pinching force to keep the handle from spinning in the

hand. Handles with shallow, circumferential grooves or with knurling allow better friction with the fingers so that a secure grasp requires less force. Small diameter, shaped instrument handles produce a mechanical stress that may cause digital nerve compression. When working edges are sharp, the instrument performs more of the work; when the edges are dulled, additional operator force is required to achieve the same result. Sharp instruments are important for reducing excessive force during instrumentation.¹⁷

Automatic Instruments

Practitioners should consider use of automatic instruments (high-speed handpiece, slow-speed handpiece, belt driven drills, lasers, ultrasonic scalers, endodontic handpieces) instead of manual hand instruments. Handpieces should be as light as possible and well balanced. Hose length should be as short as possible; extra hose length adds weight. Avoid retractable or coiled hoses. The tension in the hose is transferred to the wrist and arm as the hose is stretched. Ideally, a pliable hose with a swivel mechanism in the barrel of the hand-piece so that it can rotate with minimal effort should be used.¹⁶

Magnification and Procedure Scopes

These devices can help the clinician prevent from gradually tilting his or her hand and leaning forward toward the patient.¹⁸

- Microscopes: Using a microscope lets the clinician focus the eyes specifically on operating field. There is no need to flex the neck, upper spine, and lower back to improve visibility.
- Dental loupes: Most frequent used. They offer $\times 2-5$ magnification. They do not allow more than 25° forward tilting of the head. Loupes are of two types - flip up

loupe, they can be flipped during procedure but are bulky and need to be realigned frequently.

Dentist Microbreaks

Frequent breaks should be taken to relax the body parts. Work positions should be constantly changed for moving the muscle workload from one area to another. A dentist can take a break to perform stretches' by the chair side.¹⁹

Scheduling

The appointment schedules should be planned to provide sufficient recovery time and to avoid muscle fatigue. Alternate easy and difficult cases should be undertaken with buffer periods.¹⁴

Training of Dental Personnel

Training is essential for any health-care setup. It ensures that the employees are well versed about the occupational hazards, and they can self-volunteer in identifying and controlling the possible risks.¹⁹

Supervised Exercise

While there is evidence in the literature that poor physical conditioning may increase the risk of musculoskeletal injury, there is no empirical support for the success of using stretching or exercise techniques in the prevention of MSDs. Exercise and stretching for the treatment of an MSD should be under the supervision of a physician or physical therapist. Injury could incur or a previous injury might be exacerbated by improperly performed exercises.¹⁶

Conclusion

The subject of ergonomics lays down the foundation of dental training. Proper ergonomics should be inculcated in every aspect of dental practice, including instrument designing, planning of workstations, and should be implemented while performing clinical work. The application of ergonomic principles that identify, point

out, and modify postural inadequacies is necessary. The ergonomics and healthy workplace help the dental surgeons increase their performance without putting at risk their own health. One of the main goals of ergonomics in dentistry is to minimize the amount of physical and mental stress that sometimes occurs day to day in a dental practice.

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